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User Involvement In Decision-Making In Information Systems Development

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Abstract

This paper examines the findings of two research studies: a survey of organisational approaches to information systems (IS) development and an in-depth study of an IS research and development project. It compares the findings of the two studies to examine to what extent users are excluded from decision-making processes in IS development and by what mechanisms users may be excluded. The implications of structural and conceptual biases in IS development are discussed.

1. Introduction

The involvement of system users is seen as a critical success factor in information systems development (Ives & Olsen, 1984; Barki & Hartwick, 1994). However, while users may be encouraged to participate in development processes, this does not mean that users are truly involved as equal participants, or co-agents, in those processes. Kappelman & McLean (1992) argue that it is not so much user participation, as user *involvement* which leads to Information System success: that “state of psychological identification with some object, such that the object is both important and personally relevant”.

User involvement can be problematic while information systems professionals perceive users as unable to make up their minds and an unnecessary complication to the ‘real’ processes of design (Oliver & Langford, 1987), and so exclude users from decision-making wherever possible. Beath & Orlikowski (1994) observed an ambivalence between the recommendation for “strong user involvement” in a particular development methodology and the degree to which users could be expected to be true co-agents with IS professionals.

While some researchers have proposed alternative methodologies which facilitate more significant user involvement (Mumford & Henshall, 1983; Checkland & Scholes, 1990; Avison & Wood-Harper, 1990; Goldkuhl & Rostlinger, 1993), in commercial IS development only part of a methodology may be used. A methodology may be abandoned part-way, as marketing and sales issues take priority over system requirements (Curtis et. al., 1988), or the development approach may be customised locally, with components selected from several different commercial methodologies (Hardy et. al., 1994).

It is this use of parts of a methodology, without a requirement to commit to the philosophical approach underlying that methodology, which poses the greatest challenge to

true user involvement in information systems development. Markus & Bjorn-Andersen (1987) observe that the influence of users in development decisions is constrained by IS professionals, who may exert technical power (through the possession of technical expertise), conceptual power (by shaping users' concepts of what IT can provide), symbolic power (by shaping user expectations of how IT should be used) and structural power (by developing IT policies and procedures which constrain user choices). Whilst the adoption of user-centred methodologies may help to undermine the exercise of conceptual power, IS professionals may in turn undermine these methodological constraints by the exercise of structural power in choosing only to use selected parts of those methodologies, avoiding commitment to the requirement for true user involvement and forming less experienced developers' conceptual understanding of IS development objectives. As an example of this, one of the developers interviewed for the case study (discussed below) admitted that when he attended a training course in SSADM (Structured Systems Analysis & Design Methodology), he was amazed to find that the methodology was intended to be user-centred: over the many years that he had been working with that methodology, he had never seen it applied in that way. It is not the methodological approach *per se* which determines the extent and influence of user-involvement, but its application: how it is used and to what end.

Even when there is a high degree of user involvement at early stages of the system development life-cycle (SDLC), for example when defining system requirements, users' influence on the system outcome can be subverted through decisions taken at a later stage. Eason (1982) describes a window of opportunity at the design stages of development: because there is a time-lag between the point when IS professionals appreciate the implications of technical alternatives for the target system, and the point when users reach this understanding, the contribution of users to decision-making is limited to that period of time when many initial technical decisions have been made and the design is gradually being frozen. If users are denied access to decision-making during this window (the design and modelling stages of the SDLC) then they cannot exert a significant influence upon the form of the system outcome.

In this paper, an attempt is made to examine two research issues: (i) to what extent users are excluded from decision-making processes in IS development and (ii) by what mechanisms users may be excluded. This is achieved by comparing two different research approaches to the subject. In the first study, the approach was tailored to investigate the 'big picture': a survey of Senior IT Managers was conducted, to determine to what extent, and in what ways, users were involved in information systems development in UK companies. In the second study, a more in-depth investigation was conducted, via a series of interviews with members of a multi-disciplinary research and development project, to investigate the *role* of IS professionals in determining the degree of involvement and the influence of system users in system design decisions.

2. A Survey Investigation Of Approaches To IS Development

The first study was performed via a postal survey of the most senior IS/IT manager in a sample of UK organisations, to determine their approach to information system

development (Gasson & Holland, *forthcoming*). Because of the problem identified above: that it is the way in which a methodology is used, not the methodology *per se* which determines the extent and influence of user-involvement, the framework shown in figure 1 (Gasson, 1994) was used to classify approaches to information systems development. Respondents were asked to give details of their organisation's approach for different stages of the system development life-cycle, so that differences between stages could be assessed.

Results were derived from a sample of 49 valid responses, from the IT managers of large to medium UK companies across a wide range of industrial sectors. Of the survey respondents, 32 companies had developed an Information System in-house; the other 17 companies had contracted out all or part of the system development; results from the two sub-populations were analysed separately, which gave some interesting results.

2.1 The Research Framework

The framework in figure 1 was devised to permit the approach to IT development to be assessed over a wide range of dimensions, rather than relying upon descriptions of the methodology which would not give information as to how that methodology was applied.

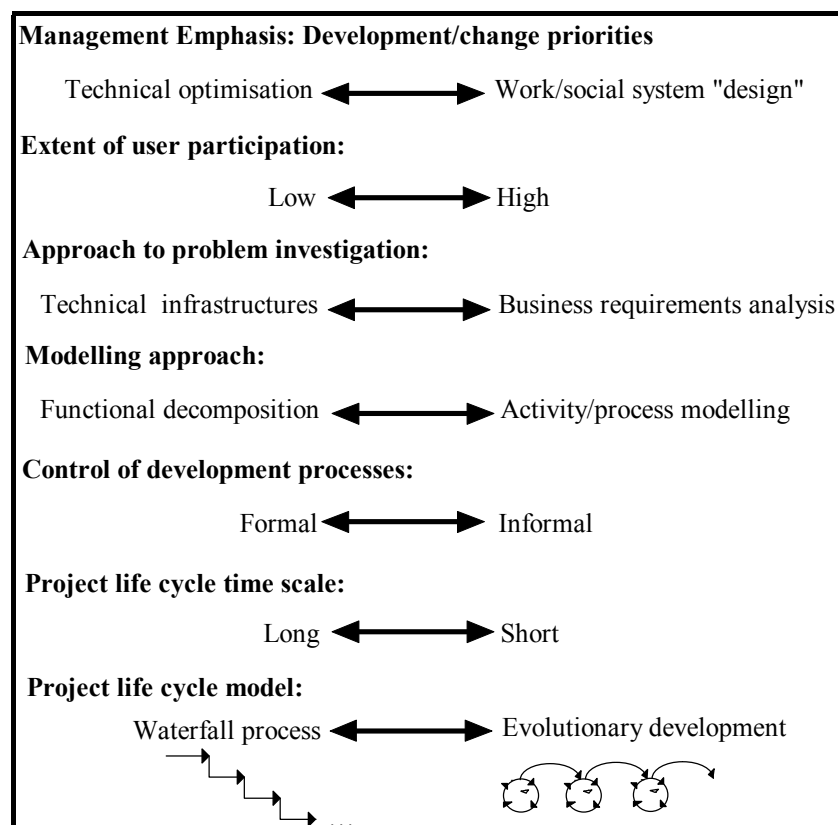


Figure 1: Framework For The Classification of Approaches To IS Development

The design of this framework visually represents a philosophical position: the left-hand-side represents 'hard' (technical/functional) approaches to development, the right-hand-side 'soft' (business-process/human-centred) approaches. By mapping development approaches over the dimensions of this framework, the philosophical approach becomes apparent. The seven dimensions of the framework are:

i) Development/change Priorities

The question of whether the information system is technically optimised, socially optimised, or optimised for socio-technical use is critical to its success in supporting organisational work (Hedberg & Mumford, 1975; Heller, 1987). The 'strategic alignment' literature promotes the concept that change managers will align technical change approaches to business priorities rather than exploring technical opportunities (Scott Morton, 1991).

ii) Extent Of User Participation

Information systems professionals may or may not choose to use those parts of a methodology which promote a high degree of user involvement. This dimension assesses both the extent of user participation and (qualitatively) the degree to which users are involved in decision-making processes.

iii) Approach To Problem Investigation

There is evidence that a technical/functional emphasis to the determination of system requirements leads to adverse effects upon the organisation, such as the fragmentation of jobs (Corbett et. al., 1991), poor system usability (Hedberg & Mumford, 1975) and inappropriate match to work tasks (Heller, 1987). The business and work requirements approach at the other end of the spectrum takes a more holistic perspective, aligning the system change with the needs of the organisation (Scott Morton, 1991).

iv) The Approach To System Design & Modelling

The functional decomposition approach is based in scientific reductionism: this leads to the exclusion from the target system of those human faculties which allow the system to adapt (Corbett et. al., 1991). At the other end of the spectrum lies a more holistic approach: system requirements are analysed as a set of human activity processes which provide multiple perspectives on the objectives of the system (Checkland & Scholes, 1990).

v) Control Of Development Processes

Formal, structured development approaches exclude users from involvement in design decisions, as their only contact with the process is via the validation of documents which they may not be in a position to understand fully (Corbett et. al., 1991); an informal development process permits much wider interactions, permitting designers to gain a wider understanding, both of the application domain and of general system design issues and permitting users to learn about the potential of the technology to support their work.

vi) Project Life Cycle Time Scale

A long time scale, coupled with a single-stage project life-cycle may lead to the 'big bang' phenomenon: such a high level of resources have been invested in the development project that managerial expectations of its successful outcome will be very high and there will be a reluctance to commit further resources to address any shortcomings in the system design. A short time scale permits the system to be re-designed if it fails in supporting vital business operations or appropriate work activities, as the sunk investment is much smaller.

vii) Project Life Cycle Process Model

An approach to IS development which is based upon the 'waterfall' model, where each stage of the development process is considered complete before the next stage begins constrains user influence upon design decisions, because of the time-lags involved in user understanding of the technology (Eason, 1982). An evolutionary approach based on short cycles of analysis, design and implementation, permits users to exercise the experience gained on the previous development cycle in decisions taken in the current cycle.

2.2 Findings Of The Survey

Figure 2 gives a graphical summary of the findings of the survey, mapped onto the research framework. Each organisation's approach to IS development was assessed, over six of the seven dimensions encompassed by the research framework, using a seven-point scale which represented the 'softness' of the approach. The exception to this measure was the process model. It was felt that, in a postal survey, it would not be feasible to obtain consistent - and therefore comparable - data over a scale of seven points between waterfall and evolutionary process models, so respondents were asked to select one of two extremes: the result shown is the average value of the sample.

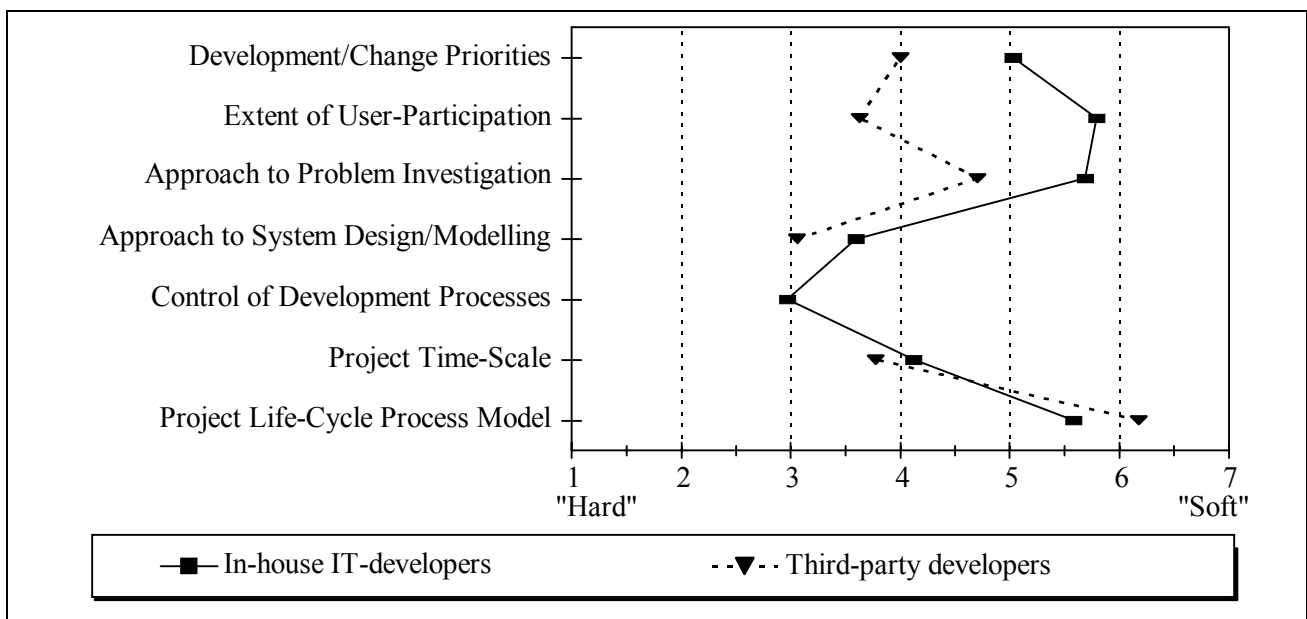


Figure 2: Survey Findings Mapped Onto The Research Framework

2.2.1 Differences Between In-House And Third-Party Developers

The first finding was that over most dimensions of the research model, the approach to information systems development was softer when companies performed development in-house than when they contracted out their development. In particular, user-involvement was markedly less, for system development contracted to a third-party, than for development performed in-house (whereas the other factors shadowed the in-house development trends with a slight shift to the hard end of the spectra). This could have been for a number of reasons: perhaps the need for greater control over third-party developers led to more mechanistic development approaches on the part of those developers, to ensure that contractual obligations were met, or perhaps the type of system suitable for development by

a third-party does not call for such interactive development approaches. However, the types of system which were implemented by third-party developers were not significantly different to the types which were developed in-house.

2.2.2 Differences In Approach Over The System Development Life-Cycle

Whilst the findings presented in figure 2 were aggregated for all stages of the system development life-cycle (SDLC), those given in figure 3 are broken down into the three main phases of the SDLC: (i) problem investigation and analysis, (ii) system design & modelling and (iii) system implementation. It can be seen, dramatically, that the approach to the system design stage of the SDLC has a noticeably more technical/functional emphasis than the approach to problem investigation/requirements analysis or the approach to system implementation; this emphasis is reflected in the commensurately low degree of user-involvement at this stage of the SDLC. This result is striking because it confirms the hypothesis of Hornby et. al. (1992) that both managers and information systems professionals perceive system design as a primarily technical process - design for technical functionality, rather than *appropriate* design, is prioritised.

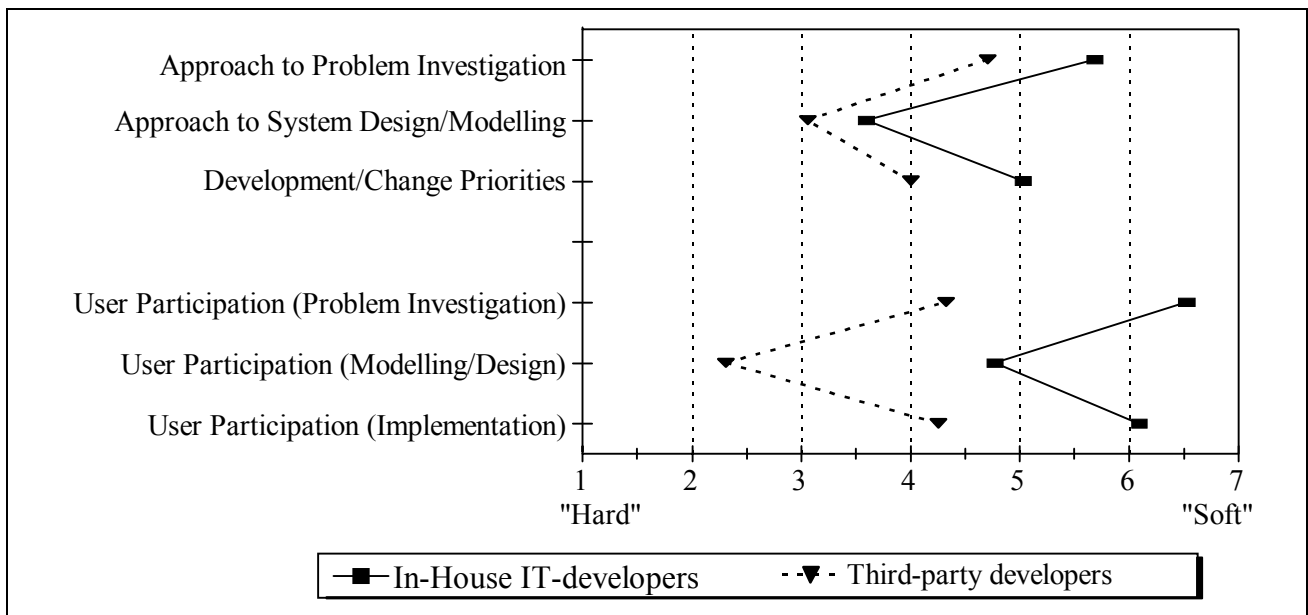


Figure 3: Approaches To IS Development At Three Main Stages Of SDLC

In other words, managers expect developers to have frozen the system requirements by the start of the design stage of the SDLC, while the research evidence is that, patently, they are not in a position to do so (Curtis et. al., 1988; Guindon, 1990). Curtis (1992) observes that system professionals spend a large part of their time during the design stage in developing a shared model of the design, but users are largely excluded from this stage of the development - thus they are excluded from the basis for informed decision-making.

Studies of the processes of software design have shown that system design and modelling is a recursive process: designers attempt to fit previously encountered design solutions to known system requirements, re-defining requirements when potential solutions prove unworkable (Malhotra et. al., 1980; Guindon, 1990). The absence of users, who can contribute to dialogues concerning appropriate solutions and impose constraints as to how

system requirements should be re-defined, is disastrous at this stage. Curtis et. al. (1988) describe designers subverting design meetings by using them to provide opportunities for filling gaps in their knowledge - for example taking the opportunity to question users about ill-understood requirements during design walkthrough meetings. Thus it can be seen that excluding the users from design processes not only minimises their influence on the stage at which the *form* of the system outcome is determined, but is counter-productive from the perspective of the technical designers, who expend so much effort attempting to make additional opportunities for user-contact.

An examination of the development methodologies reported, shown in figure 4, does show the majority of respondents using structured (i.e. functional decomposition) methods for all stages. But there is no significant migration from non-structured to structured methods at the design stage, so the low-level of user involvement at this stage cannot be due solely to the type of methodology in use. In fact, the group which shows most increase at the design stage (and maintains this level into the implementation stage) is that of methodologies to automate, to a greater or lesser extent, system and program generation: fast-build tools, such as the use of 4GLs in Rapid Application Development, CASE or DataBase Management Systems. However, this group of tools could equally well be used to *include* users, in evolutionary approaches which assess potential system impacts upon users and their work, as to exclude users from the development process.

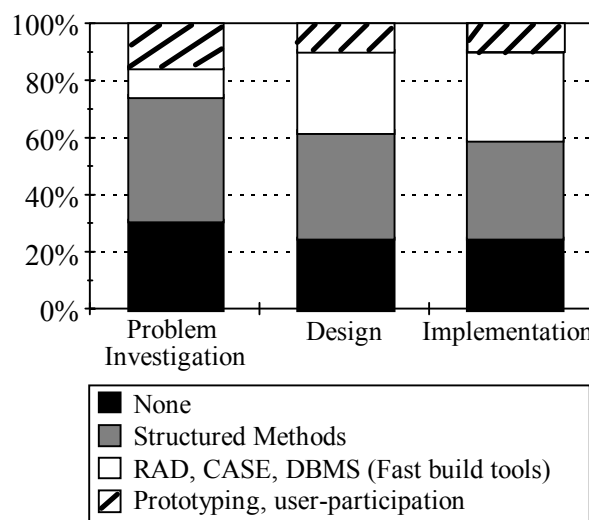


Figure 4: Reported Methods Used For IS Development At Various Stages of SDLC

Although this sample is relatively small (only those 32 companies who performed their own development in-house consistently reported tools used in development), it is reasonable to infer that the selection of a particular methodology does not primarily determine the extent to which technical/functional considerations are given priority over organisational/business requirements, or the extent to which users are included in development processes. The factor which most determines the extent of user involvement is the way in which the process is managed and approached: the perceptions of managers, system developers and users as to what is a legitimate domain for each stage of the system development life-cycle.

3. Findings Of The In-Depth Study Of A Multi-Disciplinary Research & Development Project

This study was concerned with a multi-disciplinary research and development project, based at a UK University, to design a computer-based system to support interactive student learning. It was conducted through an analysis of the design documents produced by the project team, and through a series of interviews with project team members. As the interviews took place after a decision had been made to abandon the project, some of the team-members' *post-hoc* attitudes could be interpreted as defensive: triangulation was used between interviews, to derive a representative picture of the project. Although an external project sponsor was involved, the sponsor's involvement was limited to contact via progress meetings - for this reason (and as access was complicated by the sponsor's withdrawal from the project), the sponsor's contact-staff were not interviewed as part of this study.

From the beginning of the project, there was an explicit recognition of the need for a high degree of user-involvement, to permit evaluation of the student-learning benefits of the system. A decision was made by the project manager, a senior academic psychologist, to recruit equal numbers of psychologists and IS professionals onto the team and to use an iterative prototyping model for the system development process: this model is given in figure 6. It is clear that, from the beginning, the psychologists were seen as proxy (and powerful) users by both themselves and the IS professionals on the team: they were there both to evaluate the learning benefits of the target system and to ensure that the system was designed for optimum usability.

3.1 The Research Framework

The research framework used for analysis in this study was that proposed by Markus & Bjorn-Andersen (1987) and shown in figure 5. The influence of users in development decisions is constrained by information systems (IS) professionals who may exert power over users in four ways:

- ◆ technical power may be exerted in advocating a particular course of action without providing users with the evidence to make their own evaluations
- ◆ structural power may be exerted by developing IT policies and practices which constrain user choices
- ◆ conceptual power may be exerted by shaping users' concepts of what IT can provide
- ◆ symbolic power may be exerted by shaping user values with respect to IT (normally through the provision of system exemplars).

		Target of power exercise	
		Issues of fact	Issues of values
Context of power exercise	Specific development project	Technical	Conceptual
	IS management policy	Structural	Symbolic

Figure 5: Types of Power Exercise (Markus & Bjorn-Andersen, 1987)

3.2 Research Findings

A comparison of the intended process-model (figure 6) with the actual process-model (figure 7) of the project is illuminating. From the beginning, there appears to have been a dichotomy of approach between the two disciplines, despite attempts by the project manager to co-ordinate process-paths, which reflected team-members' disparate interests. Two separate system requirements documents were produced, one reflecting innovations in the *use* of the system, another reflecting its basis in leading-edge *technology*. Even when the results of the initial requirements documents were combined, two rival requirements specification documents were produced, each reflecting only part of the other perspective.

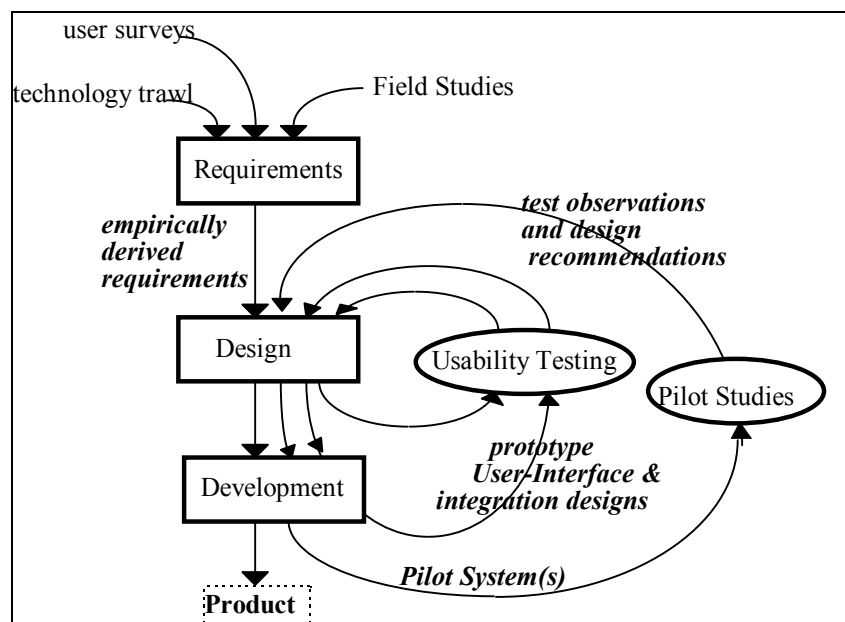


Figure 6: The Proposed Process Model For The R&D Project

It would appear that team-members from neither discipline fully understood the requirements of the other discipline and both sub-groups attempted to resolve the resulting cognitive dissonance by prioritising their own requirements. The need for IS professionals and users to learn from each other during system design and development is a common

thread in information systems literature: Eason (1982) highlights the time-lag between developer understanding of technical potential and user understanding, while Curtis et. al. (1988) discuss the critical role of the “expert designer” - who has prior experience of a particular application-domain - in educating other, technical team-members. However, this team lacked the integrative mechanisms necessary for such learning. Both disciplines attempted to control the development process: the psychologists by agreeing project task-structures and deadlines with the project-sponsor, the IS professionals by using the problematic nature of the unproven technology to separate the technical development processes from learning-evaluation.

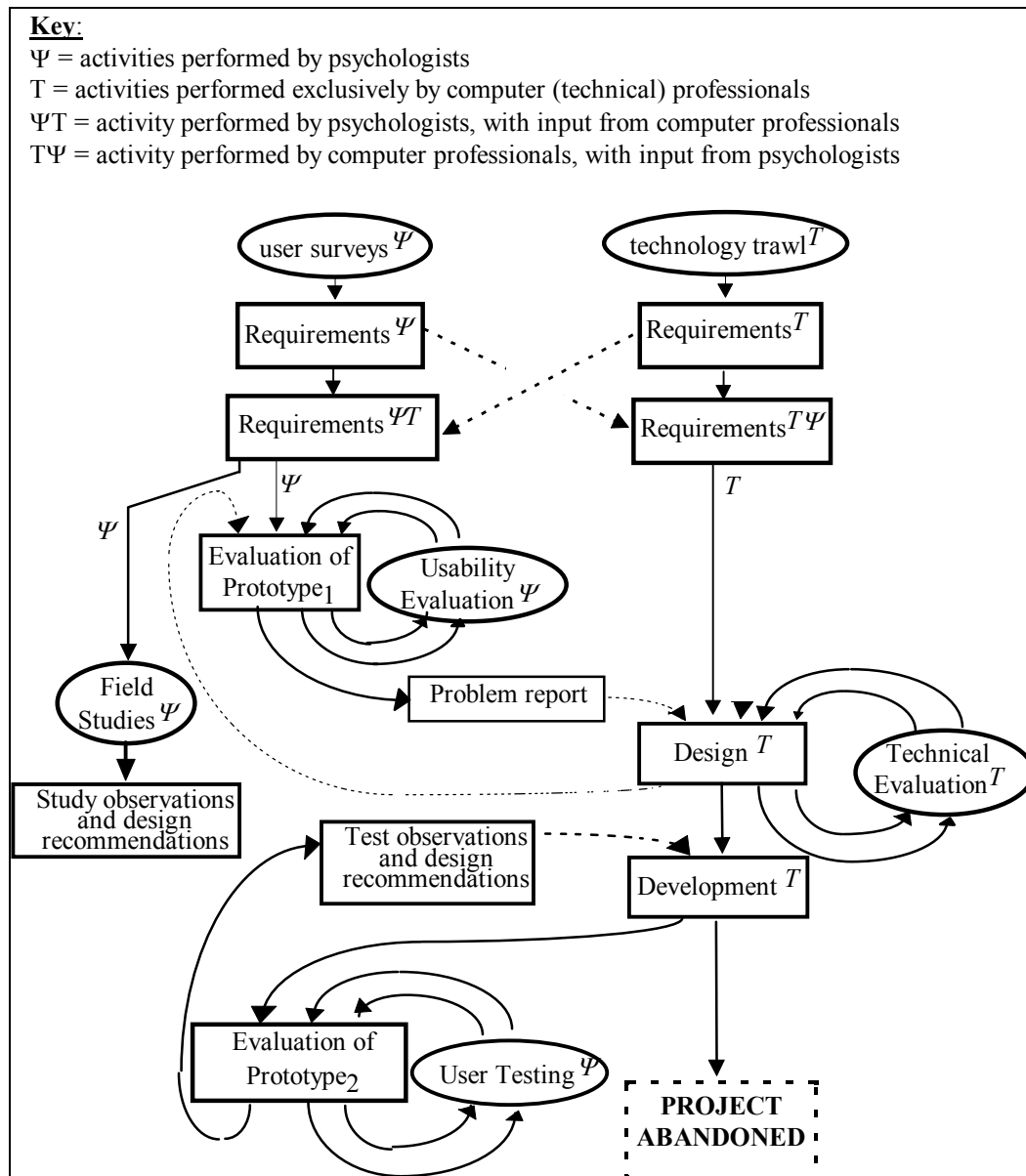


Figure 7: The Actual Process Model For The R&D Project

The integrated design and development processes from the intended process-model (figure 6) became split into two, separate process-loops, controlled by the two, separate halves of the project-team in the actual process-model (figure 7). In response to the psychologists' attempt to exert structural power (by defining project tasks), the IS professionals gained

control of the process by using structural dependencies between the tasks. The technical nature of the production of prototypes for evaluation gave the IS professionals the ability to exert technical power, as the psychologists did not have the expertise to produce these prototypes. Although there was a concerted effort, on the part of the psychologists, to participate in the design of the initial prototype (Prototype₁ in figure 7), this appears to have been thwarted by their dependence upon the IS professionals to configure the technology.

There appears to have been an implicit agreement between the two IS professionals working on this stage of the project that the first prototype was not intended to be incorporated into the target design, but was produced as a diversionary tactic, to occupy the psychologists while the IS professionals proceeded with the 'real' design. While this was partly a negative reaction, on the part of the IS professionals to what were perceived as unrealistic deadlines for the initial prototype (which had been set by the psychologists, in their attempt to gain control over the project), the IS professionals frequently used the term 'flower arrangers' to refer to the psychologists on the team - a revealing metaphor for their perception of the relative value of the contribution of technical and user requirements. When asked explicitly why the design and lessons learned from the first prototype were not used for the second prototype, the response from one of the IS professionals was:

"Well the cycle broke down because it was such a naff prototype. I think we just generally ignored any requirements that came out [*from the psychologists*], because we had much better ideas that we felt were ready to go: what we wanted to do for the first 'real' prototype. Obviously our minus one [*Prototype₁*] was produced - but we generally just disregarded it".

The use of the name "minus one" for Prototype₁ reveals its perceived lack of relevance for the intended system outcome: at the same time as the psychologists were evaluating this prototype, the IS professionals were engaged upon the development and evaluation of a prototype for a completely different system design (Prototype₂ in figure 7). This was not communicated to the psychologists. Thus the IS professionals were able to exert symbolic power, by shaping psychologists' expectations of the system: the psychologists were more likely to accept design suggestions from the IS professionals following evaluation of the first prototype, as anything had to be better than the existing design!

The psychologists attempted to exert conceptual power over the IS professionals by the performance of field studies on commercially-available systems for similar purposes. However, these were not read by the IS professionals, who exerted their own conceptual power by prioritising technical requirements over user-requirements when selecting appropriate technology. They were able to do this as the psychologists had been placed in a weak position structurally: the evaluation report from the first prototype was not completed, as it became clear at this point that the design of the first prototype had been abandoned. The evaluation results (and by association, the psychologists' contribution to the project so far) were therefore meaningless. Once a second system prototype had been produced, technical and usability evaluation still took place as two disparate processes, conducted in isolation from each other, with neither process informing the other. It would appear that the project was then abandoned, for a number of complex reasons - not least that communications between team members had almost completely broken down. Although the ostensible reason given was the withdrawal of the project sponsor, the project failed to find another sponsor because the body of work produced proved insufficiently coherent to attract further funding.

One of the most striking issues which arose from an analysis of the interviews was the formality of communication between the two 'sides' of the project team: the psychologists and the IS professionals. The team size was relatively small - at no time did the core team exceed six members - yet most of the communication between IS professionals and psychologists appears to have been via formal specification documents. It appeared that the IS professionals treated the psychologists on the team as proxy users and therefore dismissed them as an unnecessary distraction from the core task of designing the technical system, while the psychologists felt frustrated and resentful at their dependence upon the technical expertise of the IS professionals: both sides tried to legitimise their priorities by the production of 'official' project documents - an explicit attempt to exert conceptual power. In pursuing reasons for the integrative failure of the two disciplines, it was observed that the team members had been accommodated in two separate offices: one for the psychologists and one for the IS professionals. When asked why the disciplines had not been mixed in their accommodation, the internal project manager commented that the two disciplines had refused to share an office, but the psychologists' perception was that the IS professionals had refused to share an office as they did not want to 'waste' time in educating the psychologists in the technology to be used. The psychologists made repeated requests for tuition in the technology, but these were refused on the basis that meeting them would divert the IS professionals from the tasks necessary to meet project deadlines - another exercise of structural power.

This case study revealingly illustrates the exercise of all four types of power on the part of the IS professionals, most of which appeared to be explicitly directed to exclude the proxy users who were perceived as an unnecessary diversion from the 'real' processes of design. The psychologists were observed to have attempted to exert both conceptual and structural power over the IS professionals, but were unable to exert technical or symbolic power, as they were in a position of dependency with respect to the technical expertise which was required to exert these two types of power in a context where the design process was defined as primarily technical. Even when the psychologists had exerted structural power by taking control of the project deadlines, the IS professionals were able to subvert this control by the use of their technical power, in producing a throw-away prototype.

Also revealed is the importance of recognising both IS developers' and users' learning processes as legitimate design activities. Both interest groups on this project appeared to act as they did because they had insufficient understanding of the requirements and the necessary activities of the other group. If the project process-model had included tasks designed to educate each of the two groups in the others' domain, it is likely that the project would have been more successful. However, integrative communication mechanisms and organisational structures were also needed, to allow the two groups to reach a common set of interests. As the IS professionals were permitted to work together, as a separate organisational unit, and as system design was perceived by the whole project team as being primarily a technical activity, the IS professionals were able to re-define and control the central processes of the project and to exclude the evaluation and use studies which had formed the *raison d'être* of the research project. A comparison of the intended process model with the actual process model (figures 6 and 7) illustrates to what extent the IS professionals were able to exclude users from the central processes of design and decision-making.

4. Conclusions

The two studies discussed above raise common themes which occur in other areas of the information systems development literature: the perception of the system design phase of information systems development as a primarily technical task and the exclusion of users from the decision-making processes of system design, even when there is an overall managerial emphasis on user-participation in the Information System development.

The first study illustrates graphically the extent to which users are excluded from the design stage of development and that this is largely seen as appropriate by managers. Users of systems which are provided by third-party development are particularly prone to exclusion from the design process. The significant decrease in user-participation during the design stage of development is matched by the swing to a functional/technical emphasis on development (away from a business/work-process emphasis) during this stage. System design is perceived as a technical process, for which organisational considerations have little importance. However, this is the very stage at which users are able to make a realistic contribution to the system definition, because of the time-lag in user understanding of technical issues. No matter how effectively users have participated in the processes of system requirements determination, requirements are re-defined at this stage or interpreted in a different way and users need to participate in these processes of decision-making. This stage of the process is controlled and directed almost solely with technical priorities, by technical developers, introducing a structural bias in development processes.

The second study explores the mechanisms of this exclusion. Although it is not possible to make generalisations from a single study, the explicit and intended exercise of different types of power by IS professionals to exclude the proxy users from decision-making processes is a fascinating phenomenon which, in the author's previous work-experience as a systems designer, was not uncommon. It is also useful to reflect on the limited ways in which users may exert power in design processes: because these processes are seen as primarily technical, most users lack the background to participate in decision-making on equal terms, they are therefore unable to exert technical or symbolic power in response to that exerted by IS professionals. This constraint exists only because system design is perceived as a primarily technical area, rather than one in which organisational and use issues have equal priority - if the latter perception prevailed, users would have the same opportunities to exert power as IS professionals. But for organisational and use design requirements to have equal priority with technical and functional requirements, stakeholders' conceptual biases need to change:

- (i) educational activities, for both technical staff (with respect to organisational and user domains) and users (with respect to technical and functional domains) need to be perceived as legitimate, in the context of IS development
- (ii) the perceptions of managers, IS professionals and users need to change, so that the design stage of development is not seen as having primarily a technical focus.

This paper initially addressed two research issues: (i) to what extent users are excluded from decision-making processes in IS development and (ii) by what mechanisms users are excluded. From the studies examined above, it appears that information systems professionals do exert significant power to exclude users from decision-making during the

system design stage of development, when the form of the system is being determined. However, it would appear that such power is exerted, not through the selection of particular methodologies, but through the identification of system design with technical, rather than organisational and work-related activities. This single factor produces both the organisational structures which allow information systems professionals to exert this power unchallenged by users and the selection of methodologies which reinforce, rather than challenge the technical and exclusive nature of design processes. It produces a 'victim' mentality among users, who see themselves as dependent upon the technical expertise of information systems professionals, rather than recognising that relationship for what it is: a mutual inter-dependency, where their own, application-domain expertise is equally significant. It also permits information systems professionals to limit their responsibility to technical design issues, abdicating responsibility for decisions which affect the extent to which information systems are both appropriate and usable.

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